

09/24/99

09/24/99

A

PTO/SB/05 (4/98)
Approved for use through 09/30/2000. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL <small>(Only for new nonprovisional applications under 37 C.F.R. § 1.53 (b))</small>	Attorney Docket No.	7602-PA01CP
	First Inventor or Application Identifier	GARY A. RAYNER
	Title	VEHICLE DATA RECORDER
	Express Mail Label No	EM468592829US

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.	ADDRESS TO: Assistant Commissioner for Patents Box Patent Application Washington, DC 20231
---	--

1. <input checked="" type="checkbox"/> *Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original and a duplicate for fee processing)	5. <input type="checkbox"/> Microfiche Computer Program (Appendix)	
2. <input checked="" type="checkbox"/> Specification (preferred arrangement set forth below) [Total Pages] 18 -Descriptive title of invention -Cross References to Related Applications -Statement Regarding Fed sponsored R & D -Reference to Microfiche Appendix -Background of the invention -Brief Summary of the Invention -Brief Description of the Drawings (if filed) -Detailed Description -Claims(s) -Abstract of the Disclosure	6. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary) a. <input type="checkbox"/> Computer Readable Copy b. <input type="checkbox"/> Paper Copy (identical to computer copy) c. <input type="checkbox"/> Statement verifying identity of above copies	
3. <input checked="" type="checkbox"/> Drawing(s) (35 U.S.C. 113) [Total Sheets] 2	ACCOMPANYING APPLICATION PARTS 7. <input checked="" type="checkbox"/> Assignment Papers (cover sheet & document(s)) 8. <input type="checkbox"/> 37 CFR §3.73(b) Statement (when there is an assignee) <input checked="" type="checkbox"/> Power of Attorney 9. <input type="checkbox"/> English Translation Document (if applicable) 10. <input checked="" type="checkbox"/> Information Disclosure Statement (IDS)/PTO-1449 <input checked="" type="checkbox"/> Copies of IDS Citations 11. <input type="checkbox"/> Preliminary Amendment 12. <input checked="" type="checkbox"/> Return Receipt Postcard (MPEP 503) (Should be specifically itemized) 13. <input checked="" type="checkbox"/> *Small Entity Statement(s) (PTO/SB/09-12) <input type="checkbox"/> Statement filed in prior application, Status still proper and desired 14. <input type="checkbox"/> Certified copy of Priority Documents(s) (if foreign priority is claimed) 15. <input type="checkbox"/> Other.	
4. Oath or Declaration [Total Pages] 2 a. <input checked="" type="checkbox"/> Newly executed (original or copy) b. <input type="checkbox"/> Copy from a prior application (37 C.F.R. § 1.63 (d)) (for continuation/divisional with Box 16 completed) i. <input type="checkbox"/> DELETION OF INVENTOR(S) Signed Statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§1.63(d)(2) and 1.33(b)		
*NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).		

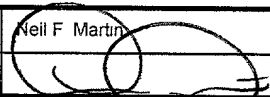
16 If a CONTINUING APPLICATION, check appropriate box and supply the requisite information below and in a preliminary amendment.

☐ Continuation ☐ Divisional ☒ Continuation-in-part (CIP) of prior Application No. 09/020,700, filed February 9, 1998

Prior application information. Examiner G. Chin Group / Art Unit. 3614

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS					
Name	BROWN, MARTIN, HALLER & McCLAIN, LLP				
Address	1660 UNION STREET				
City	SAN DIEGO, CALIFORNIA 92101-2926				
Country	USA	Telephone	(619) 238-0999	Fax	(619) 238-0062

Name (Print/Type)	Neil F. Martin	Registration No. (Attorney/Agent)	23,088
Signature		Date	September 24, 1999

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27 (c)) — SMALL BUSINESS CONCERN

Docket Number: 7602-PA01CP

Applicant, Patentee, or Identifier: Gary A. Rayner

Application or Patent No.: Unknown

Filed or Issued: Herewith

Title: VEHICLE DATA RECORDER

I hereby state that I am:

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN I-Witness, Inc.

ADDRESS OF SMALL BUSINESS CONCERN 7980 #C Sevan Ct., San Diego, CA 92123

I hereby state that the above identified small business concern qualifies as a small business concern as defined in 13 CFR Part 121 for purposes of paying reduced fees to the United States Patent and Trademark Office, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year, and (2) concerns are affiliates of each when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby state that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

☒ the specification filed herewith with title as listed above.

☐ the application identified above.

☐ the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern, or organization having rights in the invention must file separate statements as to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization having any rights in the invention is listed below:

☒ No such person, concern, or organization exists.

☐ Each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28 (b)).

NAME OF PERSON SIGNING Gary A. Rayner

TITLE OF PERSON IF OTHER THAN OWNER President

ADDRESS OF PERSON SIGNING 7980 #C Sevan Court, San Diego, CA 92123

SIGNATURE

Gary A. Rayner

DATE 9/24/1999

VEHICLE DATA RECORDER

CROSS-REFERENCE TO RELATED APPLICATION

5 This is a continuation-in-part of application Serial No. 09/020,700, filed February 9, 1998, titled "SEQUENTIAL IMAGE STORAGE SYSTEM WITH PRE-EVENT HISTORY."

BACKGROUND OF THE INVENTION

10

Field of the Invention

 The present invention relates generally to devices for recording imagery and other data during operation of a vehicle and, more specifically, to a device that stores such data during the time interval surrounding a triggering event such as detection of an impending vehicle collision.

15

Description of the Related Art

 Various recorders have been used to gather and retain data obtained from vehicle sensors. One well-known such recorder is the in-flight data recorder and cockpit voice recorder, sometimes referred to as the "black box" recorder, typically carried by commercial and military aircraft. These devices record certain operating parameters of the aircraft, as well as the voices of the operators, and have found use in setting maintenance schedules, or to assist in determining the cause of an accident. Data recorders have been known to use magnetic tape or solid-state storage devices.

20

25

 The ever-increasing use of motor vehicles has created a complex and expensive system of determining liability for the damages which result from accidents. Inevitably, it is difficult to reconstruct the events leading up to, and resulting from, the accident impact, as witness testimony is often unreliable and contradictory, and the physical remains generally do not contain sufficient evidence of the actual incident. A device to gather and record data from a wide range of operating parameters would be of great use, provided that the data covered the time leading up to the accident, as well as the accident itself, and that the data was secure so that it could be admitted in proceedings to determine liability.

30

-2-

Efforts have been made to construct recording devices which are lighter, more versatile, and more secure in their data storage. For example, U.S. Patent No. 5,497,419 to Hill discloses a device for recording sensor data which included provisions to compress and decompress data, as well as to encrypt the stored data to enhance the integrity of the data. U.S. Patent No. 5,056,056 to Gustin discloses a device to record various analog signal inputs occurring before and after a triggering event. U.S. Patent No. 5,581,464 to Woll et al. discloses an event recording apparatus to monitor the operational parameters of a vehicle. U.S. Patent No. 5,262,813 to Scharton discloses a device to trigger the operation of a camera mounted in a vehicle upon the occurrence of an impact. U.S. Patent No. 5,499,182 to Ousborne also discloses an recording apparatus to monitor the operational parameters of a vehicle. U.S. Patent No. 5,311,197 to Sorden et al. discloses a device to trigger the operation of a location reporting device in a vehicle upon the occurrence of an event such as an impact. Each of these devices has certain limitations which reduce its applicability as a secure storage device for recording numerous sensor inputs occurring before and after a triggering event.

A disadvantage of some prior vehicle data recording devices is that they are not fully integrated or self-contained. Rather, they include a data recorder located remotely from and coupled by electrical cables to the video camera or other sensor that obtains the data to be recorded. Another disadvantage of some prior vehicle data recording devices is that they are not located in the vehicle cabin at a position that is both efficient for data-gathering and convenient to use. It would be desirable to provide a self-contained, compact, conveniently and efficiently located recording device that records video or other types of data during a time interval preceding a triggering event, such as a detection of an impending accident. These problems and deficiencies are clearly felt in the art and are solved by the present invention in the manner described below.

SUMMARY OF THE INVENTION

The present invention relates to a self-contained vehicle-mounted device for capturing video imagery in response to a triggering event. The device includes a housing in which the electronics and related elements of the invention are contained. These elements include one or more data sensors, at least one of which is an image sensor, such as a charge-coupled device, that senses

visible light, infrared radiation or other optical phenomena representing video imagery. Also included are a data sensor circuit and a capture circuit. The data sensor circuit responds to the triggering event, and may include data sensors coupled to vehicle systems such as a speedometer, tachometer, brake, turn signals or the like, or other data sensors such as an accelerometer or a vehicle position sensor. The triggering event may be, for example, a sudden change in acceleration indicative of an impending collision, or it may be a change in the signal provided by any such data sensor, including the image sensor. The capture circuit is coupled to the image sensor and captures a signal representing the video imagery by recording it in a digital memory, by transmitting it to a remote location, or by other suitable means. The capture circuit terminates capture of the signal in response to the data sensor circuit sensing a triggering event. Note that data describing circumstances leading up to the time capture was terminated will have been captured. The data can be analyzed to help police, insurance or other investigative personnel understand those circumstances. In some embodiments of the present invention the device may continue to capture data for a predetermined time interval after the triggering event.

The device is mounted in the vehicle cabin a manner that provides a clear field-of-view for the image sensor. For example, it can be mounted on the windshield or on the dashboard of the vehicle, with the image sensor directed either forwardly toward action occurring on the other side of the windshield or rearwardly toward action occurring in the vehicle cabin. In some embodiments of the present invention, the device may include two such image sensors, one directed forwardly and the other rearwardly.

In a particularly advantageous embodiment of the invention the device is integrated with a rear-view mirror. In other words, the housing is similar in size and shape to that of a conventional automotive rear-view mirror assembly and includes, in addition to the elements described above, a mirror and other features commonly included in conventional automotive rear-view mirrors. In such embodiments, the device is mounted to the windshield or a surrounding area of the vehicle in the manner of a conventional rear-view mirror.

The foregoing, together with other features and advantages of the present invention, will become more apparent when referring to the following specification, claims, and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, reference is now made to the following detailed description of the embodiments illustrated in the accompanying drawings, wherein:

Figure 1 is a perspective view of a rear-view mirror vehicle data recorder device of the present invention mounted on an automobile windshield;

Figure 2 is a perspective view of a vehicle data recorder device of the present invention with suction-cup mounts for mounting to an automobile windshield; and

Figure 3 is schematic block diagram of the vehicle data recorder device.

DESCRIPTION OF PREFERRED EMBODIMENTS

As illustrated in Fig. 1, a rear-view mirror data recorder device 10 is mounted in the cabin of an automobile 12. Specifically, in this embodiment of the invention it is mounted to the windshield 14 of automobile 12 in the manner of a conventional rear-view mirror. Like a conventional rear-view mirror, it includes a generally elongated mirror 16 that is mounted to windshield 14 with mirror 16 and its axis of elongation generally parallel to windshield 14. (They are generally parallel, but not precisely parallel, because windshield 14 has some curvature, and because recorder device 10 is pivotally mounted to provide limited two-axis adjustability, as in a conventional rear-view mirror.) Device 10 has a housing 18 with a mounting bracket 20. Mounting bracket 20 is adhesively mounted to windshield 14 in the manner of a conventional rear-view mirror. Although in the illustrated embodiment device 10 is mounted in this manner, other embodiments of the device can alternatively be mounted to the cabin roof immediately above windshield 14 in the same manner in which other types of rear-view mirrors are conventionally mounted. Similarly, as discussed further below, other embodiments of the device can be mounted to windshield 14 in any other suitable manner and, indeed, can be mounted in other suitable locations inside the vehicle cabin.

The electronics and associated elements of device 10 that are contained within housing 18 are illustrated in Fig. 3. Two video cameras 22 and 24, which are preferably charge-coupled device (CCD) or CMOS silicon sensor arrays, generate signals corresponding to video imagery. Referring briefly again to Fig.

1, camera 22 is mounted in housing 18 with its optical axis 26 directed forwardly with respect to vehicle 12, and camera 24 is mounted in housing 18 with its optical axis 26 directed rearwardly with respect to vehicle 12. Both axes 24 and 26 are thus generally aligned with the direction of travel of vehicle 12 and perpendicular to windshield 14. The fields-of-view of cameras 22 and 24 are indicated by dashed lines bounding the angles bisected by axes 24 and 26, but the dashed lines are for purposes of illustration only and are not intended to accurately depict the true fields-of-view, which would preferably cover the entire area ahead of vehicle 12 and the entire cabin area. The small circular aperture portion of mirror 16 through which axis 28 extends, indicated in dashed line, is preferably half-mirrored so that it appears to be mirrored to an observer, yet transmits light to camera 24. Nevertheless, in other embodiments of the device this portion may be transparent and unmirrored.

Returning to Fig. 3, a high-speed analog-to-digital (A/D) converter 30 digitizes the signals produced by cameras 22 and 24 and multiplexes them onto a digital data bus via digital control logic 32. Device 10 operates under the control of a central processing unit 34. Central processing unit (CPU) 34 may include a microprocessor, microcontroller or similar device and associated program memory. CPU 34 is programmed to perform the functions described in this specification. Because the descriptions of these functions below are sufficient to enable any person skilled in the art to which this invention relates to program CPU 34, program code and the manner in which it is programmed are not described in this specification. CPU 34 is synchronized to A/D converter 30 via synchronization and timing information circuitry 36.

Under control of CPU 34, digital signals representing the video imagery are stored in dynamic random-access memory (DRAM) 38 that is configured as a continuous-loop buffer. CPU 34 or associated address counter circuitry defines the continuous-loop scheme by employing wrap-around memory addressing, in which the highest memory location in a predetermined addressing sequence is adjacent or next to the lowest. Incoming digitized data signals are written to memory locations in DRAM 38 in accordance with the addressing sequence until all allocated locations have been written to, at which time the data signals stored at the next location in the sequence are overwritten with further incoming data signals.

Device 10 includes sensors in addition to cameras 22 and 24, including a forward accelerometer or G-force sensor 40, a lateral accelerometer or G-force

sensor 42, a microphone 44, and a global positioning system (GPS) receiver 45. G-force sensors 40 and 42 are coupled to another A/D converter 46 via low-pass filters 48 and 50, respectively. Microphone 44 is coupled to A/D converter 46 via an amplifier 52 and another low-pass filter 54. G-force sensor 40 is mounted with respect to vehicle 12 in an orientation in which it is sensitive to changes in acceleration in a direction parallel to the direction of travel of the vehicle. Such changes may be indicative, for example, of a collision or sudden braking before a collision with a vehicle in front of or to the rear of vehicle 12. G-force sensor 42 is mounted with respect to vehicle 12 in an orientation in which it is sensitive to changes in acceleration in a direction perpendicular or lateral to the direction of travel of the vehicle. Such changes may be indicative, for example, of a vehicle colliding with the side of vehicle 12. Microphone 44, being integrated within enclosure 18 (see Fig. 1), is particularly sensitive to sounds occurring inside the cabin of vehicle 12, such as the voices of the driver and any passengers. GPS receiver 45 receives GPS satellite signals and determines from them the geographical position of vehicle 12. GPS receiver 45 and its antenna 47 are, like all other electronics and associated elements described above, disposed inconspicuously and securely inside housing 18. This location harmonizes with the location of device 10 on windshield 14 or nearby because radio frequency energy emanating from satellites above vehicle 12 penetrate windshield 14 more readily than metallic portions of vehicle 12. Under control of CPU 34, A/D converter 46 multiplexes and digitizes the signals produced by these sensors. The digitized sensor data are stored in DRAM 38 along with the digital signals representing the video imagery.

CPU 34 monitors the digitized signals representing the acceleration data to which G-force sensors 40 and 42 are responsive. If CPU 34 determines that the acceleration data exceed a predetermined threshold that is believed to be indicative of a collision or other event that would warrant investigation, it copies data from the buffer memory to a more permanent non-volatile memory 56, such as Flash memory. Memories 38 and 56 thus together define a two-tier system, in which the first tier records data in a continuous-loop fashion, and the second tier provides more permanent storage for data in the first tier in response to a triggering event. Data stored in memory 56 in accordance with this scheme are not overwritten unless the entire system is reset by an operator. Preferably, device 10 includes security measures to prevent inadvertent or unauthorized resetting, such as placing the button (not shown) or other sole means for

-7-

resetting device 10 inside enclosure 18 or in another relatively inaccessible location.

Although in the illustrated embodiment a change in acceleration data that exceeds a predetermined threshold is defined as the triggering event that causes CPU 34 to terminate data acquisition and copy the contents of DRAM 38 to memory 56, in other embodiments a change in any other monitored sensor signal can similarly be defined as the triggering event. Also, although data acquisition can be terminated upon occurrence of the triggering event, in other embodiments data acquisition may continue after occurrence of the triggering event for some predetermined time interval. Thus, so long as a sufficient amount of pre-event data are retained and not overwritten, additional frames of video data or other sensor data can be gathered during and after the collision and stored in memory 56 following the pre-event data.

Multiple data acquisition rates are accommodated by sampling and recording the data streams at different rates. For example, the data stream from microphone 44 can be sampled at 15.625KHz or 15,625 samples per second. G-force sensors 40 and 42 can be sampled at 100 to 700 samples per second. The actual recording rate for such data could simply record the maximum G-force experienced, e.g. four times per second. The image data stream will generally be sampled at the slowest rate, typically ranging from one to 60 samples per second, although four times per second is believed to provide sufficiently useful information for accident investigators.

The data acquisition rate will also affect the amount of time data can be recorded before the previously-entered data are overwritten. At the rates disclosed above, the device of the present invention will typically store 80 frames of video data, together with the associated audio and acceleration data, for a total of 20 seconds of event history. Nevertheless, these numbers are only exemplary, as it is anticipated that improvements in high-density, low-cost memory will enable substantial increases in capacity at minimal additional cost.

In addition to acceleration data exceeding a predetermined threshold, the triggering event can be defined as activation of a so-called "panic button" 58 by an operator such as the vehicle driver. Thus, if the driver presses button 58, CPU 34 terminates data acquisition and copies the contents of the circular data buffer defined by DRAM 38 into memory 56. Panic button 58 may be particularly useful in taxicabs, buses and similar commercial vehicles in which the driver may wish to record the actions of a passenger. In other embodiments, the

triggering event can be defined in still other ways, such as by activation of a security system protecting the vehicle against theft or vandalism.

5 Data capture can include not only storage of signals representing acquired data in memory but also, in addition or alternatively, transmittal of such signals to a remote location. Preferably, the signals are transmitted in real-time, i.e., immediately following the triggering event. A cellular telephone and modem 60 can transmit the digital signals to a suitable receiver (not shown) that is coupled to the telephone network. Cellular telephone and modem 60 and its antenna 62 are, like all other electronics and associated elements of device 10 described above, disposed inconspicuously and securely inside housing 18. The complete integration of these elements within housing 18 deters theft and tampering and does not inhibit surreptitious recording of passengers or would-be thieves. Furthermore, this location harmonizes with the location of device 10 on windshield 14 or nearby because windshield 14 is more transparent to radio frequency energy than areas of automobile 12 enclosed by metal. Although in 15 the illustrated embodiment the transmitter is cellular, in other embodiments that include a transmitter it may be any suitable type of radio transmitter or even an infrared link or similar short-range transmitter. An infrared link is contemplated in embodiments in which the acquired data are not transmitted in real-time as described above, but rather are transmitted after the triggering event. For 20 example, personnel investigating a collision may be provided with suitable receivers (not shown) that interrogate the vehicle data recording device via such an infrared link to retrieve the contents of its memory. Also, a programming unit (not shown) coupled by an infrared link to the recording device could be used to reset it or reprogram it. 25

Two other buttons 64 and 66 can be used by an operator to initiate and control the retrieval of stored data. In response to activation of buttons 64 and 66 in a predetermined manner, CPU 34 causes memory 56 to be addressed in sequence and provide the stored data on the data bus. CPU 34 also controls 30 a video digital-to-analog (D/A) converter 68 and an audio D/A converter 70, causing them to convert the data signals read from memory 56 to analog format. A video signal representing the stored video imagery data is provided at a video output connector 72. By connecting a video monitor (not shown) to connector 72, one can view the recorded imagery. An audio signal representing the stored audio data is provided at an audio output connector 74. By connecting a speaker 35 (not shown) to connector 74, one can listen to the recorded sound. A data

connector 76 is also included that provides access to the data on the data bus, either directly or via suitable input/output interface circuitry (not shown). Device 10 can be programmed via connector 76 as well. Although these connectors are included in the illustrated embodiment, as described above, in other
5 embodiments the device may not have such readily accessible outputs and may provide access to the recorded data only by means of a transmitter and receiver.

The recorded data streams are preferably output in "correlated packets" of data that are associated with the sample time for a single image frame. For example, if the memory playback is advanced by a single frame, then in the four-
10 frames-per-second example 0.25 seconds of audio data and the related G-force data will also be retrieved. For the other rates disclosed above, different sized packets will be obtained and played. When the device retrieves data at a "normal" playback mode, the data display will present a substantially continuous, substantially "real time" stream.

The active electronic elements of device 10 receive power from a power supply circuit 78. Power supply circuit 78 can receive power from the electrical system of vehicle 12 via a suitable cable 80 (see Fig. 1) or from a backup battery 82. Cable 80 can have multiple conductors, some of which carry this power signal and others of which carry signals from other vehicle systems and sensors that provide data to device 10 for recording as described above.
15 20

CPU 34 can control a light-emitting diode (LED) 84 to provide status information, such as whether device 10 is powered-up and otherwise operational or, alternatively, whether a triggering event has occurred. The convenient location of LED 84 and buttons 58, 64 and 66 where the rear-view mirror is
25 normally situated in an automobile promotes ease of operation of device 10 by a driver of vehicle 12.

As illustrated in Fig. 2, in an alternative embodiment a data recorder device 84 of the present invention has an enclosure 86 that contains all of the electronics and associated elements described above with respect to Fig. 3. In
30 this embodiment, device 84 does not include a mirror or function as a rear-view mirror. Nevertheless, it can be mounted to windshield 14 by means of elastomeric suction cups 88 and 90. In still other embodiments, it can be mounted to windshield 14 by means of a suitable adhesive, double-sided adhesive tape, or VELCRO-type hook and pile fasteners (not shown). Cameras
35 22 and 24 have fields-of-view, indicated generally by the dashed lines, that extend forwardly and rearwardly of vehicle 12 when attached to windshield 14.

-10-

The present invention provides a vehicle data recorder device that is fully integrated in a single enclosure and does not require cabling to connect cameras with remotely located recording devices. In some embodiments the device may provide a rear-view mirror function and can be used in place of a conventional rear-view mirror. In such embodiments, the recording nature of the device is advantageously not immediately conveyed to taxicab passengers, would-be thieves or others whose actions the device may be intended to monitor. Furthermore, the convenient location of the device on or near the windshield promotes ease of operation and facilitates radio and other remote transmission of data through the windshield. It also deters tampering because removal of the device, particularly in rear-view mirror embodiments, will be immediately apparent to any driver as well as persons outside the vehicle.

Obviously, other embodiments and modifications of the present invention will occur readily to those of ordinary skill in the art in view of these teachings. For example, alternative methods of mounting the device to a windshield or the surrounding area will occur to such persons as natural extensions and variations of the described methods of adhering a rear-view mirror device to the windshield and mounting a device by means of suction cups. Therefore, this invention is to be limited only by the following claims, which include all such other embodiments and modifications when viewed in conjunction with the above specification and accompanying drawings.

WHAT IS CLAIMED IS:

-11-

CLAIMS

1. A vehicle-mounted device for capturing video imagery in response
2 to a triggering event, comprising:
a housing;
4 an image sensor mounted to said housing, said image sensor sensing
optical phenomena representing said video imagery;
6 a data sensor circuit within said housing and in part responsive to said
triggering event; and
8 a capture circuit within said housing coupled to said image sensor
capturing a signal representing said video imagery and terminating capture of
10 said signal in response to said data sensor circuit sensing said triggering event.
2. The vehicle-mounted device claimed in claim 1, wherein said
2 capture circuit terminates capture of said signal a predetermined time interval
after occurrence of said triggering event.
3. The vehicle-mounted device claimed in claim 1, wherein said
2 capture circuit comprises a digital recording circuit having a digital memory and
records said signal representing said video imagery.
4. The vehicle-mounted device claimed in claim 3, wherein said
2 capture circuit further records a signal representing data produced by said data
sensor circuit.
5. The vehicle-mounted device claimed in claim 1, wherein said
2 capture circuit comprises a transmitter transmitting a signal representing said
video imagery to a remote location.
6. The vehicle-mounted device claimed in claim 5, wherein said
2 transmitter transmits said signal in real-time.
7. The vehicle-mounted device claimed in claim 1, wherein said data
2 sensor circuit comprises a sensor responsive to a change in force experienced
by said device.

2 8. The vehicle-mounted device claimed in claim 7, wherein said data
4 sensor circuit comprises a forward sensor responsive to a change in force
6 experienced by said device in a direction substantially perpendicular to a
direction of elongation of said housing and a lateral sensor responsive to a
change in force experienced by said device in a direction substantially parallel
to said direction of elongation of said housing.

2 9. The vehicle-mounted device claimed in claim 1, wherein said
image sensor is disposed behind said mirror and senses said optical
phenomena transmitted through a portion of said mirror.

2 10. The vehicle-mounted device claimed in claim 9, wherein said
4 portion of said mirror is half-silvered and partially transmits and partially reflects
said optical phenomena to provide said mirror with a uniformly mirrored
appearance.

2 11. The vehicle-mounted device claimed in claim 9, wherein said
portion of said mirror is transparent.

2 12. The vehicle-mounted device claimed in claim 1, wherein said
image sensor is oriented to sense optical phenomena impinging upon it from a
direction substantially perpendicular to a direction of elongation of said housing.

2 13. The vehicle-mounted device claimed in claim 12, wherein said
4 image sensor comprises first and second portions, said first portion oriented to
6 sense optical phenomena impinging upon it from a direction substantially
8 perpendicular to a direction of elongation of said housing, said second portion
oriented to sense optical phenomena impinging upon it from a direction
substantially perpendicular to a direction of elongation of said housing and
axially opposite said direction from which said optical phenomena impinges
upon said first portion.

2 14. The vehicle-mounted device claimed in claim 13, wherein said first
portion of said image sensor is disposed behind said mirror and senses said
optical phenomena transmitted through a portion of said mirror.

-13-

15. The vehicle-mounted device claimed in claim 1, wherein:
2 said data sensor circuit further comprises a global positioning system
(GPS) receiver identifying a geographic position of said vehicle-mounted device;
4 and
said capture circuit further records a signal representing said geographic
6 position.

16. The vehicle-mounted device claimed in claim 1, wherein:
2 said data sensor circuit further comprises a microphone;
said capture circuit further records a signal representing said sound
4 impinging upon said microphone.

17. A vehicle-mounted device for capturing video imagery in response
2 to a triggering event, comprising:
a housing having a generally elongated shape;
4 a rear-view mirror mounted to said housing and having a generally
elongated shape;
6 an image sensor mounted to said housing, said image sensor sensing
optical phenomena representing said video imagery;
8 a data sensor circuit within said housing and in part responsive to said
triggering event; and
10 a capture circuit within said housing coupled to said image sensor
capturing a signal representing said video imagery and terminating capture of
12 said signal in response to said data sensor circuit sensing said triggering event.

18. The vehicle-mounted device claimed in claim 17, wherein said
2 capture circuit terminates capture of said signal a predetermined time interval
after occurrence of said triggering event.

19. The vehicle-mounted device claimed in claim 17, wherein said
2 capture circuit comprises a digital recording circuit having a digital memory and
records said signal representing said video imagery.

20. The vehicle-mounted device claimed in claim 19, wherein said
2 capture circuit further records a signal representing data produced by said data
sensor circuit.

21. The vehicle-mounted device claimed in claim 17, wherein said
2 capture circuit comprises a transmitter transmitting a signal representing said
video imagery to a remote location.

22. The vehicle-mounted device claimed in claim 21, wherein said
2 transmitter transmits said signal in real-time.

23. The vehicle-mounted device claimed in claim 17, wherein said data
2 sensor circuit comprises a sensor responsive to a change in force experienced
by said device.

24. The vehicle-mounted device claimed in claim 23, wherein said data
2 sensor circuit comprises a forward sensor responsive to a change in force
experienced by said device in a direction substantially perpendicular to a
4 direction of elongation of said housing and a lateral sensor responsive to a
change in force experienced by said device in a direction substantially parallel
6 to said direction of elongation of said housing.

25. The vehicle-mounted device claimed in claim 17, wherein said
2 image sensor is disposed behind said mirror and senses said optical
phenomena transmitted through a portion of said mirror.

26. The vehicle-mounted device claimed in claim 25, wherein said
2 portion of said mirror is half-silvered and partially transmits and partially reflects
said optical phenomena to provide said mirror with a uniformly mirrored
4 appearance.

27. The vehicle-mounted device claimed in claim 25, wherein said
2 portion of said mirror is transparent.

28. The vehicle-mounted device claimed in claim 17, wherein said
2 image sensor is oriented to sense optical phenomena impinging upon it from a
direction substantially perpendicular to a direction of elongation of said housing.

-15-

29. The vehicle-mounted device claimed in claim 18, wherein said
2 image sensor comprises first and second portions, said first portion oriented to
sense optical phenomena impinging upon it from a direction substantially
4 perpendicular to a direction of elongation of said housing, said second portion
oriented to sense optical phenomena impinging upon it from a direction
6 substantially perpendicular to a direction of elongation of said housing and
axially opposite said direction from which said optical phenomena impinges
8 upon said first portion.

30. The vehicle-mounted device claimed in claim 29, wherein said first
2 portion of said image sensor is disposed behind said mirror and senses said
optical phenomena transmitted through a portion of said mirror.

31. The vehicle-mounted device claimed in claim 17, wherein:
2 said data sensor circuit further comprises a global positioning system
(GPS) receiver identifying a geographic position of said vehicle-mounted device;
4 and
said capture circuit further records a signal representing said geographic
6 position.

32. The vehicle-mounted device claimed in claim 17, wherein:
2 said data sensor circuit further comprises a microphone;
said capture circuit further records a signal representing said sound
4 impinging upon said microphone.

33. A method for capturing video imagery in a vehicle-mounted system
2 in response to a triggering event, said system comprising a rear-view mirror
device mounted upon a windshield of a vehicle, said rear-view mirror device
4 having a housing with a generally elongated shape, a mirror assembly mounted
to said housing and having a generally elongated shape, a image sensor
6 mounted to said housing and sensing optical phenomena representing said
video imagery, a data sensor circuit within said housing, and a capture circuit
8 within said housing, the method comprising the steps of:
said image sensor sensing optical phenomena transmitted through a
10 portion of said mirror assembly and representing said video imagery; and

-16-

12 said capture circuit capturing said video imagery and terminating capture
of said signal representing said video imagery in response to said data sensor
circuit sensing said triggering event.

2 34. The method claimed in claim 33, further comprising the step of
transmitting a signal representing said video imagery to a remote location.

2 35. The method claimed in claim 33, wherein said step of terminating
capture of said signal representing said video imagery comprises terminating
capture of said signal in response to a change in force experienced by said
4 device.

2 36. A method for capturing video imagery in a vehicle-mounted system
in response to a triggering event, said system comprising a rear-view mirror
device mounted upon a windshield of a vehicle, said rear-view mirror device
4 having a housing with a generally elongated shape, a mirror assembly mounted
to said housing and having a generally elongated shape, a image sensor
6 mounted to said housing and sensing optical phenomena representing said
video imagery, a data sensor circuit within said housing, and a capture circuit
8 within said housing, the method comprising the steps of:

10 said image sensor sensing optical phenomena representing said video
imagery impinging upon it from a direction substantially perpendicular to a
direction of elongation of said housing and forwardly through said windshield of
12 said vehicle and video imagery impinging upon it from a direction substantially
perpendicular to a direction of elongation of said housing and rearwardly with
14 respect to said vehicle; and

16 said capture circuit capturing said video imagery and terminating capture
of said signal representing said video imagery in response to said data sensor
circuit sensing said triggering event.

2 37. The method claimed in claim 36, further comprising the step of
transmitting a signal representing said video imagery to a remote location.

2 38. The method claimed in claim 36, wherein said step of terminating
capture of said signal representing said video imagery comprises terminating

-17-

4 capture of said signal in response to a change in force experienced by said device.

2 39. A method for mounting a system for capturing video imagery in
4 response to a triggering event, comprising the step of mounting upon a vehicle
6 windshield a device comprising a housing, an image sensor mounted to said
8 housing and sensing optical phenomena representing said video imagery, a data
sensor circuit within said housing responsive to said triggering event, and a
capture circuit within said housing coupled to said image sensor capturing a
signal representing said video imagery and terminating capture of said signal in
response to said data sensor circuit sensing said triggering event.

2 40. The method claimed in claim 39, wherein said housing has a
4 generally elongated shape, said device further comprises a suction-cup attached
to said housing and a mirror having a generally elongated shape mounted to
said housing, and said mounting step comprises the step of adhering said
device to said windshield.

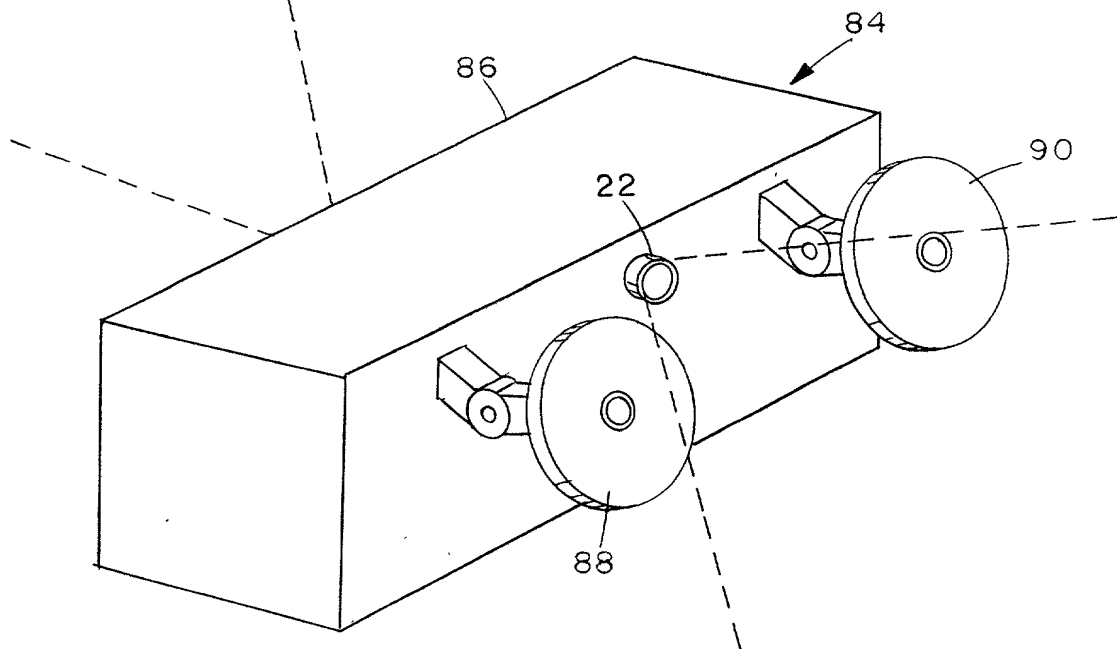
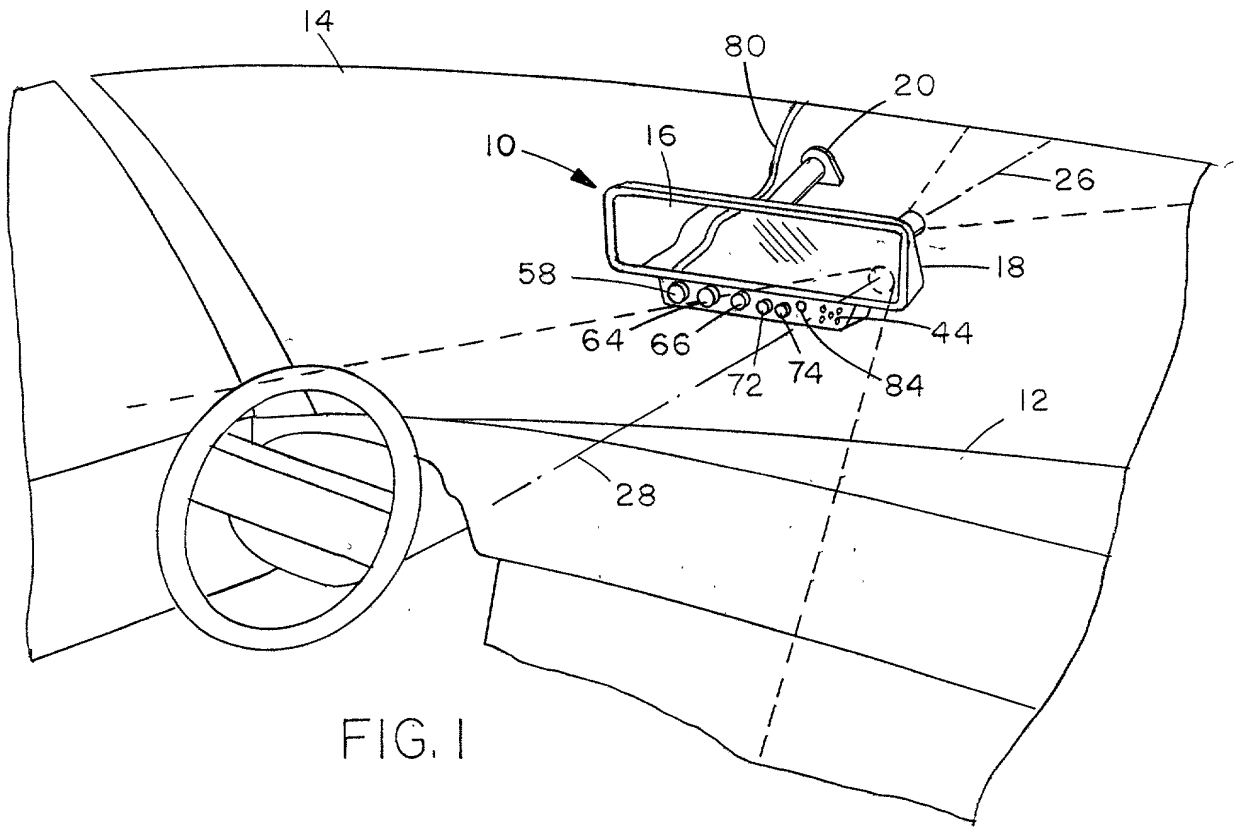
2 41. The method claimed in claim 39, wherein, and said mounting step
comprises the step of engaging said suction-cup upon said windshield.

-18-

ABSTRACT

5 A self-contained device for capturing video imagery in response to a triggering event may include a mirror and be mounted to a vehicle windshield in place of a conventional rear-view mirror. The device includes a housing in which the electronics and related elements of the invention are contained. These elements include one or more data sensors, at least one of which is an image sensor,. Also included are a data sensor circuit and a capture circuit. The data sensor circuit responds to the triggering event, and may include data
10 sensors coupled to vehicle systems such as a speedometer, tachometer, brake, turn signals or the like, or other data sensors such as an accelerometer or a vehicle position sensor. The triggering event may be, for example, a sudden change in acceleration indicative of an impending collision, or it may be a change in the signal provided by any such data sensor, including the image
15 sensor. The capture circuit is coupled to the image sensor and captures a signal representing the video imagery by recording it in a digital memory, by transmitting it to a remote location, or by other suitable means. The capture circuit terminates capture of the signal in response to the data sensor circuit sensing a triggering event. The captured data thus describe circumstances
20 leading up to the time of the triggering event. The data can be analyzed to help police, insurance or other investigative personnel understand those circumstances.

1/2



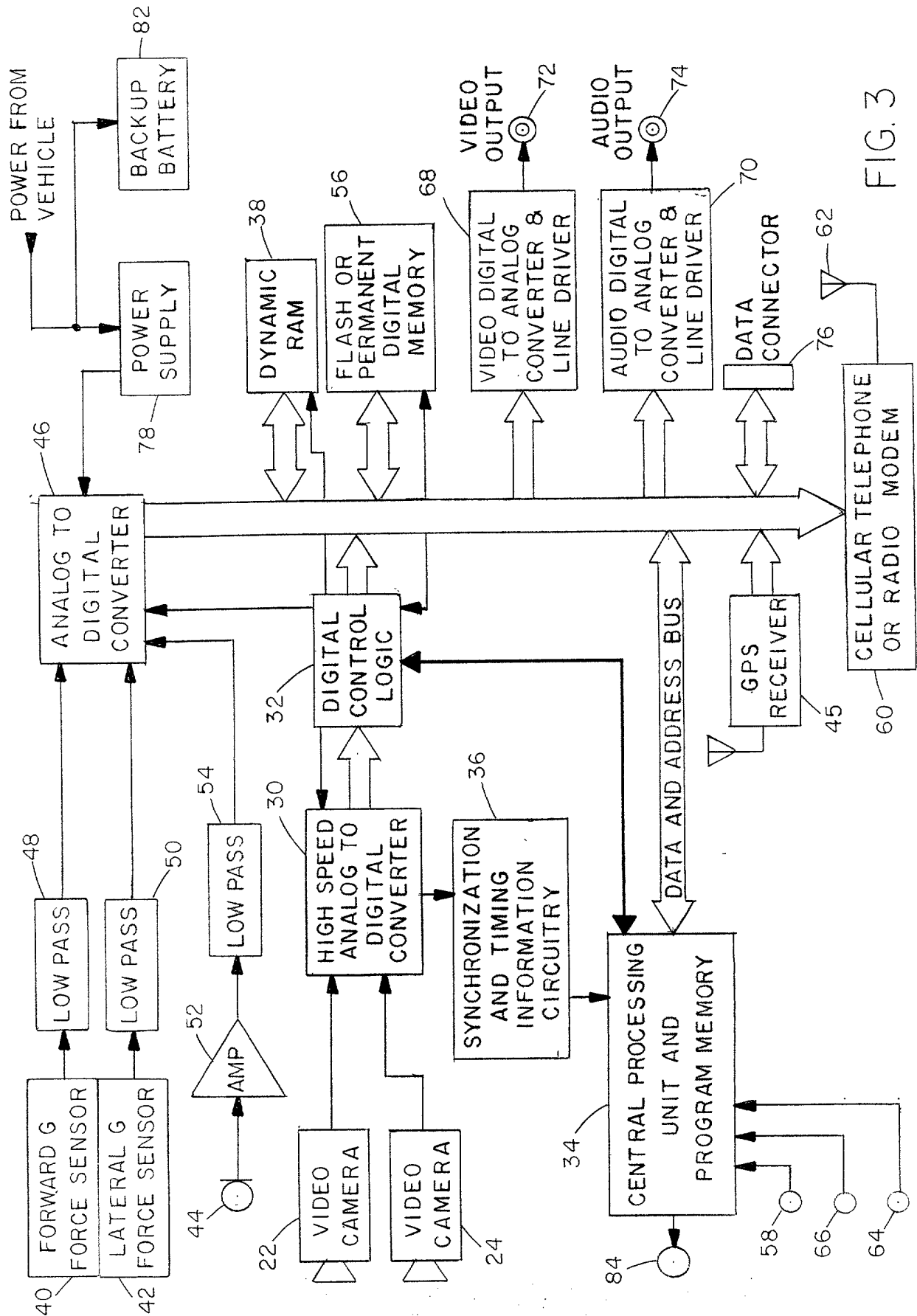


FIG. 3

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION	Attorney Docket	7602-PA01CP	
	First Named Inventor	GARY A. RAYNER	
	COMPLETE IF KNOWN		
	Application Number	Unknown	
	Filing Date	Herewith	
	Group Art Unit	Unknown	
<input checked="" type="checkbox"/> Declaration Submitted with Initial Filing	<input type="checkbox"/> Declaration Submitted after Initial Filing	Examiner Name	Unknown

As a below named Inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

VEHICLE DATA RECORDER

(Title of the Invention)

the specification of which

☒ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) as United States Application Number or PCT International

Application Number and was amended on (MM/DD/YYYY) (if applicable.)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Numbers	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto

DECLARATION - Utility or Design Patent Application

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s), or §365(c) of any PCT International application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Patent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
09/020,700		02-09-1998	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith. Registered practitioner(s) name/registration number listed below:

Name	Registration Number	Name	Registration Number
NEIL F. MARTIN JOHN L. HALLER	23,088 27,795	JAMES W. MCCLAIN ELEANOR M. MUSICK	24,536 35,623

Direct all correspondence to:

Attorney Name	NEIL F. MARTIN				
Address	BROWN, MARTIN, HALLER & MCCLAIN, LLP				
Address	1660 UNION STREET				
City	SAN DIEGO	State	CALIFORNIA	ZIP	92101
Country	USA	Telephone	(619) 238-0999	Fax	(619) 238-0062

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])				Last Name			
Gary A.				Rayner			
Inventor's Signature <i>Gary Rayner</i>				Date <i>9/29/99</i>			
Residence: City	San Diego	State	CA	Country	U.S.A.	Citizenship	Australian
Post Office Address							
Post Office Address							
City	San Diego,	State	CA	Zip	92123	Country	U.S.A.

NAME OF SECOND INVENTOR: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])				Last Name			
Inventor's Signature				Date			
Residence: City		State		Country		Citizenship	
Post Office Address							
Post Office Address							
City		State		Zip		Country	

☐ Additional Inventors are being named on the supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.